2. OBSERVATIONS ON ECOLOGY AND BEHAVIOUR OF THE RHESUS MONKEY *MACACA MULATTA*, IN ASARORI

Introduction

The present account gives the more important results of a nine-month field study on the ecology and behaviour of rhesus macaque (*Macaca mulatta*) in the Asarori Forest, near Dehra Dun (Uttar Pradesh, Northern India), carried out during January to October 1976. The forest is of moist deciduous type, and consists mainly of large *sal* trees (*Shorea robusta*). Here a fairly good population of the rhesus as well as the Hanuman langur (*Presbytis entellus* Dufresne) coexist.

Observations

1. *Group size and composition*: Some 14 groups of rhesus monkeys were present comprising a total of about 500 individuals; four solitary males were also observed. Detailed studies were made on six groups, whose size varied from 5-*c.* 90 (mean 32.8) individuals. All groups, except one, were of the bisexual multimale type. The exception was an all-juvenile group of 5 individuals. The number of adult males in a group varied from 2-7 and of adult females from 4-27. The adult sex ratio was male 1: female 2.2-3.7. The mean ratio for adult female to young infants for four groups was 1:0.7; this shows high reproductivity (70%).

2. *Home range*: The home range area varied from 1.3-13.4 km² and was correlated with group size (correlation coefficient r=0.937, significant at $P = 0.01$). The home ranges of neighbouring groups overlap considerably (23.5—100%, mean 61.1% of their area).

3. *Food and feeding*: The rhesus is largely vegetarian, eating various components of some 85 different plants. But some animal food is also eaten regularly, this consists mainly of insects of all kinds such as beetles (including water beetles) and their grubs, moths, butterflies and their pupae, grasshoppers, termites, cocoons of hymenoptera and spiders and their webs. Insects are caught with a quick movement and the uneatable appendages are removed with the hand before eating. During the monsoon months two species of fungi are eaten in abundance. Occasionally they eat earth from termite mounds and lick the lime washed walls of forest quarters. Strange food, such as carrots, Indian *chapaties*, when offered is rejected after inspection and testing it by a little chewing. During summer the animals drank daily or on alternate days, and in winter about once a week. Casual intake of water in winter occurred regularly by licking dew from leaves.

4. *Foraging routes*: A group was followed from dawn to dusk for 15 consecutive days to determine the actual distances travelled for foraging. The length travelled ranged from 1050-3500 m (mean 1803.3 ± 160.2) and this determines the distance between the two consecutive roosting sites. The two are closely related (correlation coefficient $r = 0.63$, significant at $P = 0.01$).

5. *Roosting*: Groups of tall trees serve as the night roosting sites, which are changed every night, as was noted in detail in two groups for a period of one month each. Certain areas of home range are used frequently for roosting and may be called "roosting sites." In both groups 'the area of 'roosting sites forms about 47% of the total area of the home range, irrespective of the size of the latter. The mean distance between

the two roosting sites (for two successive nights) was 431 ± 56 m in the Harbhajwala group and 1247.5 ± 110 m for the Bada group. This feature is directly related to group size (31 and *c.* 90 respectively).

6. *Dominance* : The dominant male or leader of a group can be easily identified by his robust body and certain characteristics. His tail is carried high up with a tight end loop, especially when in encounters other animals and also in inter and intra group encounters. He usually leads a group, gives threats to intruders and gives dominance displays by shaking tree branches. Almost all females and young seek his support in case of danger. He frequently dashes to site of intra group squabbles and his presence has an immediate calming effect. His aggressive activities are more frequent than those of other males of the group, and he enjoys priorities in all activites. Curiously, he also shows some paternal behaviour whose intensity varies with the individual. One leader was observed carrying, protecting, grooming and roosting with an 8-month old infant.

7. *Intergroup relations* : Groups are intolerant of the proximity of other groups and intergroup spacing or avoidance is noticeable. Although the home ranges of neighbouring groups overlap considerably, intergroup interactions are infrequent. Only 19 interactions were noted during a period of nine months. In encounters, a dominance display is common rather than fighting. The period of interactions varied from 2 to as long as 60 minutes. Usually subordinate males lead in chase during a fight.

Intergroup dominance is positively correlated (89.5% of the cases) with group size. Sometimes the dominant male of a group mounts adult female of his own group during encounters. Four types of encounters were noticed: overtly aggressive (5.3%), aggressive (36.8%), aggressive-tolerant (10.5%) and approach-withdrawal (47.4%).

8. *Interspecies dominance* : Occasionally, rhesus and langur groups interact with one another, and the latter always displays subordination by avoiding the former. Although the langurs are larger and heavier, they withdraw and are threatened and chased by the rhesus. This agrees with Roonwal's (1976) view that some other factors other than body weight and size determine interspecies dominance.

Discussion

Group size and composition, as studied by various workers in different habitats show variation, but groups are mostly bisexual and multimale. Rarely, groups without adult males are also found (Neville 1968a; Makwana, in press). Southwick *et al.* (1965) give the average size of groups as 50 (for 5 forest groups), Jay and Lindburg (1965) 32 (for 14 groups), Lindburg (1971) 23 (for 5 groups near Dehra Dun), Neville (1968b), 41 (for 5 Forest groups near Haldwani), Mandal (1964) a range of 5-35 (for 29 groups in the Sunderbans), and Puget (1971) an unusual size range of 90-180 in northeastern Afganistan. Solitary males are also occasionally found.

The extent of home ranges also varies greatly. In Uttar Pradesh, Neville (1968b) recorded 1-3 km² in forest near Haldwani, and 0.05 km² in Haldwani town. Lindburg (1971), 16 km² near Dehra Dun and the present range is 1.3-13.4 km² in Asarori.

The roosting sites of urban groups are fixed and groups roost there every day (Southwick *et al.* 1965; Singh 1969). But in forest habitat roosting sites are changed daily (Lindburg 1971 and present study).

Foraging routes are apparently determined

arbitrarily and their length may vary from *c.* 200-3500 m; Lindburg 1971, 350-2820 m; Neville 1968b; 200-400 m; the present study 1050-3500 m). A group always travels a longer distance than the actual straightline distance between two consecutive roosting sites. Factors which may determine the length of foraging routes are the availability of food and water, the season, the position of neighbouring groups, the group size, etc.

Inspite of much overlap in the home range area, intergroup encounters are infrequent and usually group avoidance is noticed rather than fight. This situation was also observed by Southwick *et al.* (1965) and Lindburg (1971).

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3. A NOTE ON THE BREEDING AND LONGEVITY OF THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*) IN CAPTIVITY

A pair of adult Indian Pangolins (*Manis crassicaudata*) was acquired for the Nandankanan Biological Park, Orissa. The female arrived on 16th July 1973 and the male arrived on 16th July 1976. They were housed in an enclosure measuring 2.5 × 1.5 × 2 m. high. Attached to the enclosure is a dark sleeping den measuring 0.85 × 0.5 × 0.5 m high. They remain curled up throughout the day in the sleeping den and became active from late evening to early morning. They sometimes climb up a cement tree erected inside the enclosure. They are fed with red tree ants (adults, young and eggs) every evening at the rate of 600